USDA NRCS Natural Resources Conservation Service

December 2005

Use of Manures or Legumes for Nutrients

Conservation Activity Job Sheet (NJEnergy03)

Participant _____ Crop Year_____

Use of Manure, Perennial Legumes or Annual Legumes to Supply Crop Nutrient Needs

Nitrogen used in crop production is applied in large quantities to supplement soil supplies. Nitrogen typically is supplied to crops as ammonium nitrate, diammonium phosphate (DAP), ammonium sulfate, cal-nitro (ammonium nitrate + limestone) or other inorganic form.

The amount of energy needed to produce the nitrogen portion of the fertilizers is massive, almost 18,000 kilocalories of energy per one kilogram of nitrogen, and requires large quantities of fossil fuels. There is a clear opportunity to save energy by reducing unneeded nitrogen applications. Nitrogen can be produced on-site by cover crops and legume crops, and by utilizing other readily available organic sources of nutrients (such as manures) as fertilizer for crops in rotation. The producer must closely evaluate the requirements for each crop rotation, soil, and climate.

Recommended nitrogen fertilizer rates provided by crop consultants or fertilizer dealers are for the total amount of nitrogen needed to grow a crop to a specified yield. Nitrogen from manures, cover crops, and prior crop residues should be totaled and subtracted from these recommendations. Additional efficiencies can be gained by calibrating applicators, applying fertilizer products and manure accurately, and using the correct method and placement to avoid losses and spillage.

When using these alternative sources, it is still essential to follow good management practices in order to avoid damage to the crop and hazards to the environment. Because the ratio of nitrogen to phosphorus and potassium in manure is lower than this ratio in the crop, use of manure alone to supply 90 percent of the crop nutrients needs may result in an over application of phosphorus and potassium. Therefore, more than one organic source of nutrients should be used to achieve this energy enhancement. Some of the alternative nutrient sources are listed below:

Legumes and Green Leaf Manures – Legumes and green leaf manures can perform a multitude of functions on the farm. Nutrients absorbed by or retained within crop residues after harvest, are gradually released or "mineralized" when the crop is incorporated into the soil. Many factors govern when the nutrients will be released, including the carbon/nitrogen ratio, moisture content, particle size of the soil, method of incorporation, soil nitrogen levels, and temperature.

Legumes in rotations form symbiotic associations with nitrogen-fixing bacteria. Through these associations they are able to supply not only the nitrogen for their own needs but a portion of the nitrogen used by the following crop. The actual amount of nitrogen supplied depends on the species grown as well as soil and climatic conditions. In general, however, the longer the legume is allowed to grow, the greater the amount of nitrogen produced. Legumes and green manures can reduce the consumption of fossil fuels as inputs needed to produce inorganic fertilizers.

[1] Living Landscapes, Thompson/Okonagan, Ministry of Employment and Investment, Province of British Columbia, CA, 2002

Legumes are the most important of the green manures. There are several categories of legumes and green manures that are used in conservation farming.

Cover crops – Cover crops form mulch that protects the soil from wind and water erosion and greatly reduce annual weeds in the next growing season. Examples of annual legumes include red and sweet clover, hairy vetch, winter cereals, and buckwheat.

Catch crops / *nutrient conserving crops* **–** A catch crop only grows briefly and is either worked in after the main crop has been harvested or planted between two main crops. The catch crop protects the soil from erosion and minimizes nutrient loss from the soil through leaching. It can also enrich the soil by adding organic matter, nitrogen, or other nutrients. Examples of annual legumes used as catch crops are oilradish, red clover, and buckwheat.

Smother crops – A smother crop is a green manure crop grown primarily to control weeds. It is characterized by extremely dense, vigorous, and rapid growth. Smother crops usually are selected with specific weeds in mind; i.e. using fall rye against quack grass because its vigorous growth in spring coincides with the growth cycle of quack grass.

Manure – Animal waste is an excellent source for nutrients; however, manure nutrient content varies among operations and over time. Manure applications should be based strictly on the nutrient requirement of the crop to avoid over-application and reduce the potential of nitrate-nitrogen leaching into groundwater and phosphorus being transported into streams. The following steps will assure the correct amount (agronomic rate) of manure is applied.

1. Determine crop nutrient requirements, based on a realistic yield goal.
2. Deduct nutrients supplied from other sources such as crop residues and cover crops.
   a. Determine the nutrient content of the other sources.
   b. Determine the fraction of nutrients from these sources available to the crop and deduct this from the amount in #1.
3. Deduct nutrients supplied from manures.
   a. Determine the nutrient content of the manure.
   b. Determine the fraction of nutrients available to the crop in the first year of application.
   c. Calculate the application rate to supply crop needs without over-applying any nutrient.
4. Determine supplemental nutrients needed for optimum crop growth.

CSP Payment: CSP offers an annual, per acre payment for those qualifying acres in which 90 per cent of the crop nutrient requirements are supplied from green leaf manures, animal manures, cover crops and/or other organic sources. CSP also offers a small annual, per-acre payment for those qualifying acres in which annual legumes are included as part of the crop rotation, and a larger annual, per-acre payment for those qualifying acres in which perennial legumes are included in the crop rotation.

Documentation Required: Farmer or crop consultant certification of appropriate fertilizer budget and record of applications.

I certify that I reduced inorganic nitrogen applications on my farm through the use of manures, annual legumes, and/or perennial legumes.

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Signature Date